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# U.S. Coast Guard Rescue 21 Technical Consulting

## Outputs

- Written technical report to evaluate vessel communications capabilities.
- Radio frequency (RF) analysis.
- On-site vessel measurements.

Rescue 21 is a project undertaken by the U.S. Coast Guard (USCG) to modernize and upgrade its current National Distress and Response System (NDRS). This system will enhance the Coast Guard's communication capabilities, increase its response coverage area, provide a common operation environment, and provide USGC personnel with modernized tools to perform their missions. The NDRS is the maritime emergency response (911) system for the coastal U.S. and the communications infrastructure for all USCG coastal missions. Rescue 21 is a hybrid communications system composed of wireless and wired components. Rescue 21 will consist of many operating regions along the U.S. coast and waterways. Each region will have a Group Communications Center (GCC) that is networked to a Search and Rescue Station and several Remote Transceiver Sites.

The USCG entered into an Inter-Agency agreement with ITS to evaluate the simultaneous communications capabilities of the Rescue 21 vessel sub-system. The focus of the investigation was to determine the physical possibility of achieving simultaneous communications (SC) — receiving a distant radio transmission on one channel while simultaneously transmitting on one or more nearby channels. In particular, a major concern of the USCG is the ability to

monitor an emergency channel continuously while communicating on other working channels. The result of ITS's investigation was to determine if such a communication system was technically possible given the physical limitations of the 47-foot vessel (see Figure 1 below), and to produce a recommendation to either keep the existing Rescue 21 system (with possible modifications), or replace it with an alternative system.

The focus of the investigation was the following:

- (1) Link budget and radio channel isolation specifications necessary to achieve line-of-sight (LoS) communications.
- (2) Characterization of the current system, including sources of noise and interference.
- (3) Possible methods for reducing interference in the system and increasing radio isolation to meet the specifications defined in (1).



*Figure 1. 47-foot Coast Guard vessel (photograph by E.D. Nelson).*



Figure 2. ITS staff taking measurements aboard the 47-foot Coast Guard vessel (photograph by C.J. Behm).

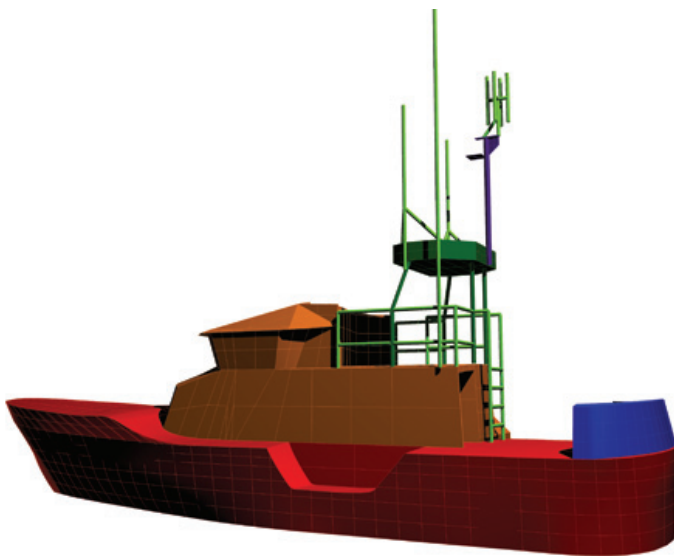


Figure 3. Model of the 47-foot vessel shown in Figure 1.

ITS's technical contributions were focused mainly in the following areas:

### ***In situ* measurements**

Multiple trips were made by ITS staff to the Atlantic City USCG Station to take measurements on the 47-foot vessel (see Figure 2). These measurements were used to characterize the system radio performance and the noise environment.

### **Propagation Modeling**

In support of the RF coverage analysis, ITS provided the Coast Guard with antenna coverage predictions using the Irregular Terrain Model (ITM) and the Advanced Propagation Model (APM).

### **Antenna Modeling**

A number of different antenna configurations were analyzed on the boat using the 47-foot vessel model in simulation software (see Figure 3).

## **Findings**

- (1) Subject to certain constraints, the Rescue 21 system was capable of providing adequate simultaneous communications on two channels between the shore and USCG vessel 47269 at 20 nautical miles.
- (2) There are multiple noise sources within the shipboard communication environment that limit the system's simultaneous communications capabilities. If these interferers are eliminated, SC can be achieved.
- (3) Simulations indicate that alternative antenna placements would provide increased isolation for the R21 radios.
- (4) The current system design can be retained, since it was found to be adequate for the specific simultaneous communications scenario described above.

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